

Smart Grid Trends, Market Forecast and
Technology Innovations 2011

WHITEPAPER



1 INTRODUCTION/FORECAST

What is the Smart Grid?

The underpinning grid infrastructure of the electric power industry is transforming on an epic scale. From the growing addition of intermittent, often distributed, renewable energy sources, to new and efficient ways that residential, commercial and industrial users are consuming electricity, the relatively static, slow-changing power transmission and distribution market is finding itself at the confluence of energy, telecommunications and information technology (IT) markets. This is driving necessary change and innovation in support of a 21st-century intelligent utility network -- a "smart grid."

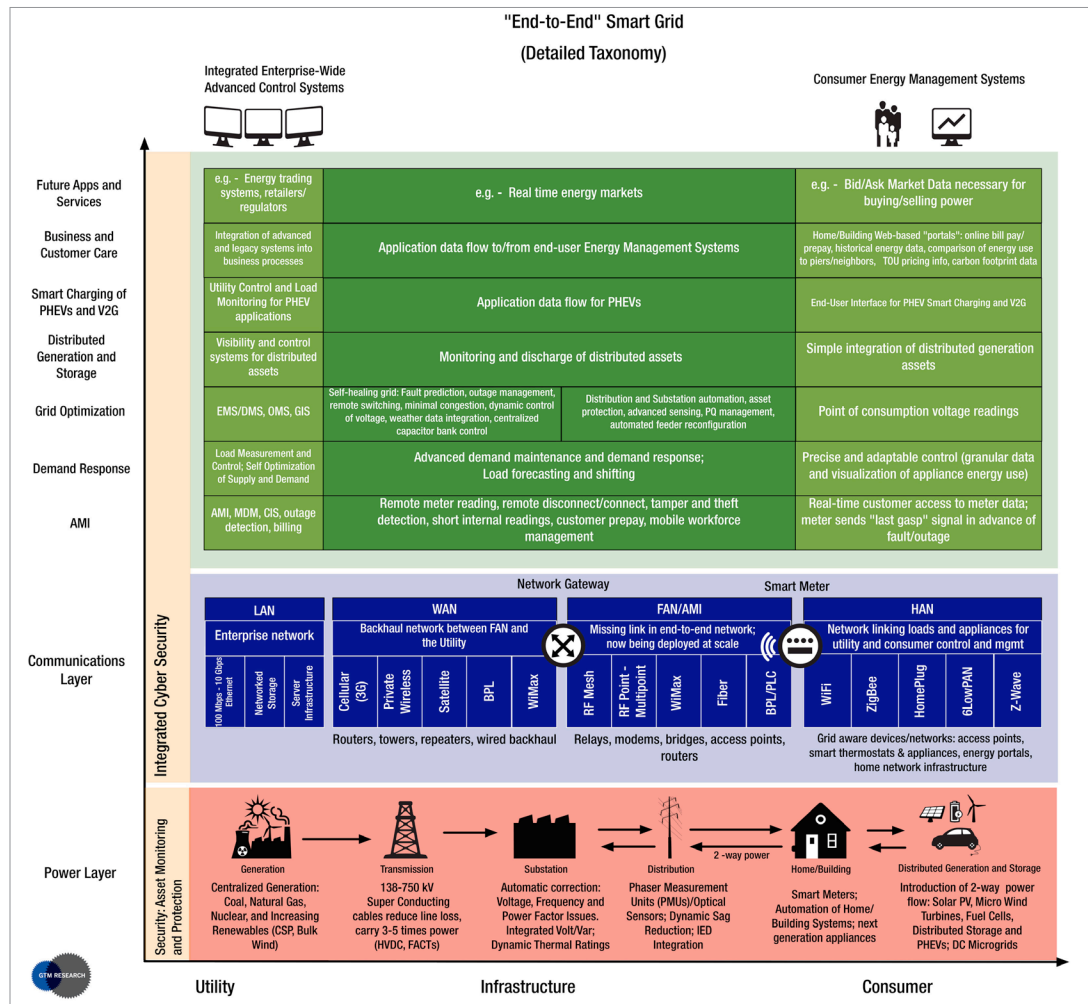
The GTM Research Smart Grid Taxonomy explains smart grid as the convergence of three industries/sectors:

- Electric Power (Energy)
- Telecommunications Infrastructure
- IT (Information Technology)

Each industry's expertise is needed to provide one of three high-level layers of a complete, and end-to-end smart grid:

- The Physical Power Layer (transmission and distribution)
- The Data Transport and Control Layer (communications and control)
- The Application Layer (applications and services)

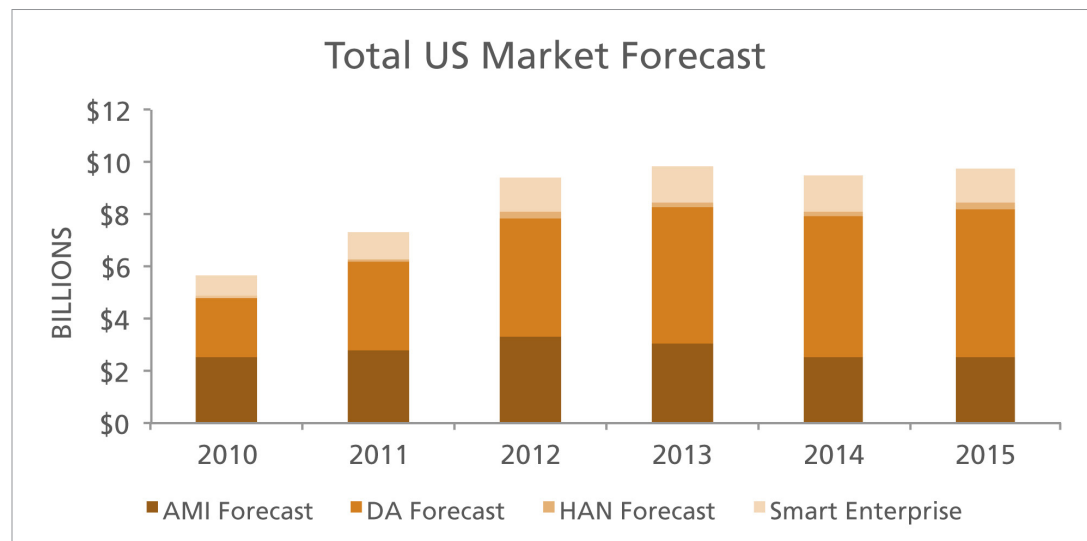
Figure 1-1: Detailed Taxonomy Diagram



Source: GTM Research

GTM Research expects the smart grid to grow from a \$5.6 billion market in 2010 to \$9.6 billion in 2015. This forecast was arrived at by adding together the following four submarket segments: advanced metering infrastructure (AMI), distribution automation (DA), home area networks (HAN) and smart utility enterprise.

Figure 1-2: U.S. SMART GRID MARKET FORECAST 2010-2015)



Source: GTM Research

Smart meters will continue to be deployed widely in the near future; indeed, we expect a 48% national deployment by 2015. However, the eventual build-out of the true smart grid must include adding communications capabilities and intelligence to the actual distribution grid, as well as the back-end utility systems, in order to make greatest use of this newly generated data. While these deployments will take decades to reach full penetration, utility executives are beginning to recognize that a robust communications architecture will be the backbone upon which all future applications will be built, and that without a smart enterprise, the nation's grids will not be sufficiently intelligent to proactively manage demand, re-route power around disturbances, integrate distributed renewables and electric transportation, and most importantly, to continue to offer reliable and affordable electricity.

A fully networked grid would: allow for virtually every piece of grid equipment to have either automation or remote control; support the growth of much higher levels of intermittent, renewable energy as states race to meet approaching RPS standards; and, from a more overarching perspective, ensure that our national economy has the fundamental platform (reliable, dependable electricity) that is vital for the nation's continued GDP growth.

Florida understands these requirements are necessary for a true smart grid, as well as grasping the clear business potential that accompanies them. Utilities and vendors alike are making great strides across the state in each major submarket.

2 EMERGING SMART GRID TRENDS

2.1 The Evolution of AMI

Advanced metering infrastructure (AMI) is currently the largest segment of smart grid activity, with approximately 45% of the total market share. A few emerging characteristics of the market can be explained as follows:

RF mesh networking continues to be the dominant solution for AMI networking on large-scale deployments; however, the costs associated with using public networks (i.e., AT&T, T-Mobile, etc.) have dropped substantially over the past year, and many in the industry speculate that smaller utilities ultimately will choose not to build out their own networks, opting instead to leverage these public carriers.

Only 6% of electric meters currently installed worldwide are smart meters. The business opportunities for metering and network players will remain substantial over the next several decades.

Look for competition and consolidation to intensify in this sector, keeping in mind the recent partnership of Itron and Cisco, not to mention Cisco's purchase of AMI networking player Arch Rock. Companies like GE, Landis+GYR, and Elster can be expected to make moves as well.

Concurrently with such partnerships and consolidation, distribution automation (DA) is set to grow in significance and become the dominant sector in the smart grid market, with a current 40% share that will be rising to 58% by 2015. With that being said, DA and its next wave of applications can potentially be delivered by the same set of vendors in the AMI space.

The state of Florida has taken initiative as an early leader in AMI rollout. The **Energy Smart Florida** program (announced in April 2009) is Florida Power & Light (FPL) Company's initiative to install smart meters throughout the entire state for about 4.5 million customers, at a cost of close to \$800 million (in part covered by \$200 million in federal economic stimulus funding). FPL has partnered with a who's-who of the smart grid field for the deployment, including major players like Silver Spring Networks for wireless communication, GE for the smart meters themselves, and Cisco for networking. Installation began in early 2010, with a target end date of 2013. Clear near-term benefits will include outage prevention and identification/rerouting, leading to faster restorations during blackouts. FPL's goal will be to use its program as a platform for future products and services ("apps") to help end-users better manage their energy use, and integrate renewable, variable power sources.

The city of **Leesburg, FL** has received a \$9.7 million federal grant for a smart meter rollout, slated to begin in mid-2011. The grant matches the city's initial funding, totaling \$20 million for the proposed overhaul. Of the Leesburg Electric Department's 23,000+ customers that will receive smart meters, 4,000 will also receive home-energy management displays to monitor their power usage directly. Leesburg has an aggressive goal of finishing their deployment by the end of the calendar year.

In 2007, the **Tallahassee City Commission** committed to rolling out 200,000+ smart meters. It was this foresight that led to an \$8.9 million federal grant in 2009 to help build upon the city's initial plans. Tallahassee is calling their project e+ (Energy Plus) SmartGrid; it's not only aiming to manage their electricity distribution more efficiently, but gas and water as well.

The **University of South Florida (USF)** Power Center for Utility Explorations was able to secure a \$15 million grant for a smart grid deployment in St. Petersburg that will serve 5,000 people (a portion of Progress Energy Florida's customers in the area). Funding was secured through Progress Energy Florida, the Governors Energy Office, Publix, and HD Supply. The three-year project has been dubbed Smart Grid with Renewable Strategic Load Pocket.

2.2 Growing Importance of DA, Grid Optimization, and Power Electronics

Historical underinvestment in the distribution grid over the past few decades will drive expansion in distribution automation (DA). All technological advancements on the smart grid, such as electric vehicles (EVs), distributed generation, and improved energy storage, are predicated entirely on this submarket. The future of the grid will need to change from reactive to proactive in order to support these new capabilities. Many experts point to DA as the real "nuts and bolts" (or the real "intelligence") of smart grid, as we move ever closer to having self-healing grids with much greater levels of situational awareness, simulation, command and control.

It is estimated that 90% of all grid failures occur on the distribution grid; disturbances at the transmission and generation levels are much less frequent. Adding automation to reduce blackouts is becoming increasingly viable due largely to the decreasing costs of both communications and distribution hardware.

GTM Research's DA forecast is predicated on power technologies, as well as the eventual full deployment of four types of devices. The first two, reclosers and automated feeder switches, are key for true DA, allowing for "self-healing" capabilities, via which power can instantaneously be re-routed around a fault. The next two devices, capacitor ("cap") banks and voltage regulators, play an integral role in grid optimization.

While Demand Response (DR) is often labeled the first "killer app" of smart grid and its optimization, it is worth noting that today's demand response solutions cannot address system stability, as the amount of time it takes (typically 10-30 seconds) for DR to take effect is still too slow. We anticipate that frequency regulation, with its much faster injection speeds, will better stabilize the nation's grid.

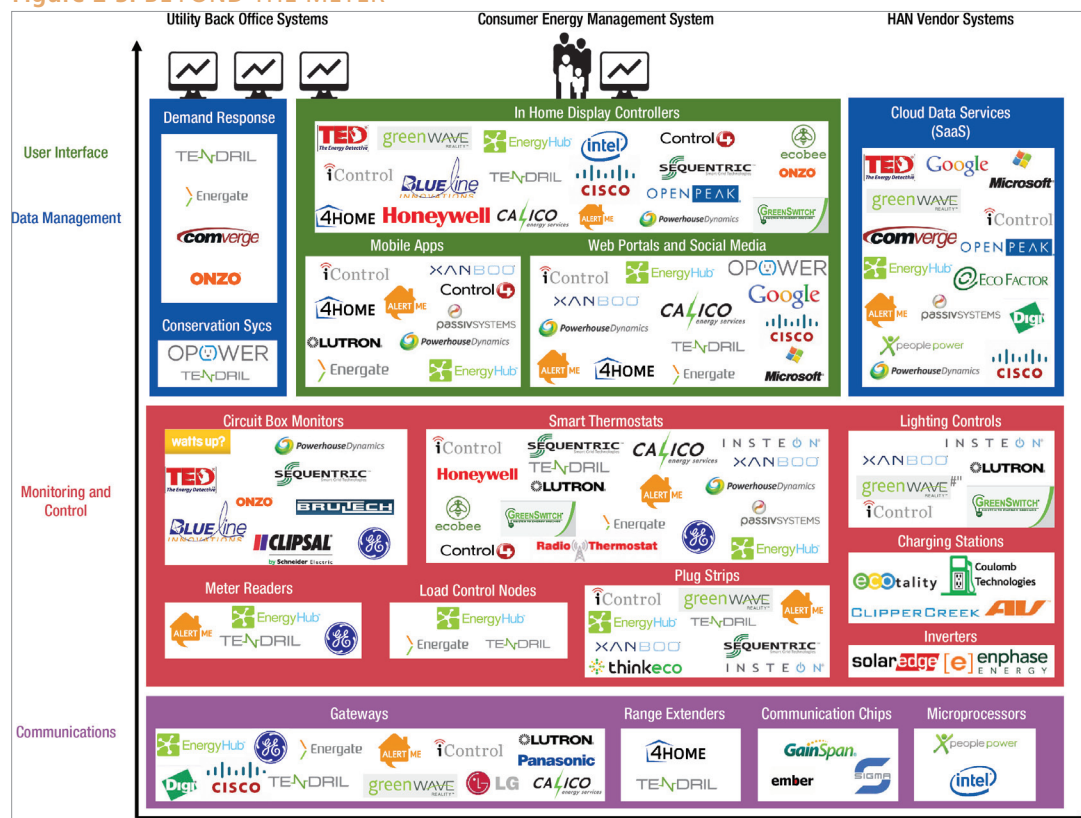
Such stability in Florida's grid space is being addressed by **Airspan Networks**. Airspan is a vendor of broadband wireless products and solutions founded in 1992 and based out of Boca Raton, FL. They have created a 1.4 GHz licensed spectrum designed for utilities to operate a private, secure, uninterrupted network for distribution automation and AMI backhaul. The company most recently won a contract with EnergyAustralia, the largest energy provider in Australia, to use its WiMAX network communications and 4G infrastructure.

2.3 The Dawn of Energy-Aware Home Area Networks

What began as a simple Wi-Fi router for home computer networking is evolving into an ever-expanding range of digital applications for the modern networked home. Over the next five years, homes will undergo a massive fundamental shift as they become digital operating systems that respond to occupants' wishes and needs with new services, features and benefits, becoming a complete Home Area Network (HAN), or "smart home."

We forecast that the U.S. market for home energy management technology will grow from \$400 million in 2011 to reach \$750 million by 2015 (note that these numbers are slightly higher than in the previous forecast chart, due to a recent update specific to the HAN market). Roughly half of the market will be products (known as home energy management systems) that are connected to the grid via AMI or broadband links; the remaining half will be residential services for utilities including technology-enabled conservation services, residential demand management and enterprise software and integration directly tied to rigging home systems to utility systems.

Figure 2-3: BEYOND THE METER



Source: GTM Research

We've identified dozens of new companies in the home energy and automation space and more than \$400 million in new venture capital funding – mostly in advance of significant revenues. These vendors will be locked in a life-and-death competitive struggle over the

coming years. We expect a massive shakeout and consolidation before a handful of leaders emerge. Distribution savvy, marketing skill and strategic partnerships will be as important, or even more important, than technology in determining the winners. The technology playing field is relatively even, while the business development battlefield is not. Our market forecast indicates a \$750 million market with six segments – enough to support 10 to 12 successful companies, but no more. The home energy management market (displays, gateways, plug strips, etc.) is overcrowded, while the areas of conservation and demand management services, and enterprise software and integration are less so.

In the recent U.S. Smart Grid Market Forecast Report, we stated that we expect the industry to spend \$13.7 billion on smart meters over the next five years. Transmission and Distribution concerns face the challenge of delivering tangible value-add to the 55 million households that will pay smart meter capital recovery surcharges for these investments in coming years. Improved reliability, remote connect/disconnect, and automated meter reading are not sufficient – in short, nobody cares enough about these types of factors. Utilities need to put a tangible face on the smart grid that consumers can touch, hold and use. We conclude that, at a minimum, every home with a smart meter should also have home energy management technology that displays consumption data, price signals, and utility messaging.

Specific to Florida, there are a number of interesting **HAN players** emerging:

The Orlando-based **Intellon** is an early player in the energy-aware home area network market. The company is a maker of chips for powerline networking; however, its purchase by Atheros (subsequently bought out by Qualcomm) is intended to mesh its products with Wi-Fi connectivity as well, allowing the firm to offer both wired and wireless solutions. At the physical layer in networking the smart home, Intellon subscribes to the HomePlug Alliance, hoping to unite numerous end-user devices.

OpenPEAK is a nine-year-old company based in Boca Raton, FL that develops multimedia touchscreen devices, telephones and device management platforms for broadband providers and utilities to deliver services at home, in the office or on the road. The company is privately held. Its company distribution model is through service provider partners and to consumers via retail.

OpenPEAK products include the OpenTablet (a sleek tablet computer), ProFrame (a VoIP phone that combines voice, video and data), OpenFrame (which combines elements of the OpenTablet and ProFrame), and OpenGateway, a television set-top box. An energy management edition provides a colorful in-home display unit.

The energy management unit displays energy information from advanced meters, consumption monitoring devices inside the home, or from utility systems. It includes support for both Wi-Fi and ZigBee (Smart Energy Profile 1.0) communications. OpenPEAK also provides managed data services (i.e., cloud services) for data archiving and access by mobile devices.

Thorn Products, an emerging smart grid home/business power monitoring company, is based in Melbourne, FL. Florida's Technology Research and Development Authority has accepted them into their high-tech business incubator, as the company develops and markets an Energy Usage Monitor that plugs into electric sockets/switches for reliable communication at the building-receiver gateway. Their goal is to create a 7% to 10% reduction on energy use via easy-to-read meter readouts.

Galtronics Telemetry is another home energy monitoring provider, with a branch in Palm Coast, FL. Their SymSystems software offers a web-based, user-friendly report of exactly how your energy is being consumed; data from water heaters, pool pumps, stoves -- virtually any major power appliance -- is transmitted to a secure web portal for a nuanced breakdown of your power bill. One unique aspect of their system is that a smart meter is not required; there is no need to wait for the utility company to get started by analyzing your energy usage and potentially start saving money.

2.4 Meter Data Management will Start Leading to Expansive and New Business Possibilities

The hidden assumption behind renewable portfolio standard mandates is that the grid will efficiently assimilate intermittent renewable power sources to reduce greenhouse gas emissions. However, this cannot be done without an intelligent grid. AMI provides data for building an intelligent grid; however, meter data management (MDM) is necessary to turn the data into intelligence.

The collection of meter data enables new and better business processes that cut across departments and organizational boundaries. Examples include improved outage management, load forecasting, market settlements, and distribution sizing. Implementing MDM is as much about business process reengineering as it is about technology. Collaborative workshops and employee education are keys to success. Utility smart grid leaders can achieve progress by using MDM vendor experts and outside consultants as facilitators.

Smart utility enterprises that implement MDM will need to be multi-network and multi-agent (like Amazon or eBay), connecting various stakeholders (such as utilities, end-users, and conceivably, electric cars), with the added characteristic of being directly tied to critical infrastructure, making systems integration and security that much more complex.

MDM in North America is probably too small to support successful IPOs by pure-play MDM companies. Vendors need to expand their offerings to create new growth opportunities, and MDM provides a springboard for new applications like consumer web portals, demand response, and outage management. Vendor MDM vision and roadmaps for the future are important both for vendor success and for satisfying emerging customer needs.

There are a handful of **Florida enterprises** helping to fulfill this vision:

FieldMetrics of Seminole, FL helps utilities monitor their power distribution and transmission lines. The company has partnered with AMI player Elster to provide sensors that retrofit to power lines, facilitating data gathering and management across the grid.

A \$500,000 grant was awarded to FieldMetrics in late 2010 to design, specifically, a multi-function optical voltage sensor platform for real-time smart grid power measurements.

Jabil Circuit is a hardware vendor that makes the chips that go into the smart meters themselves, in addition to producing solar panels and PV modules. The St. Petersburg-based company has found itself an advantageous market in the smart grid: AMI startups are not necessarily experts in the manufacturing field, and they may not want to raise the money to build their own factories. Enter Jabil. Major networking player Silver Spring has partnered with them to assemble their radio units. Jabil employs 85,000 people worldwide, and reports \$12 billion in revenue.

Solis Energy is a firm in Orlando, FL that specializes in reliable power generation for outdoor or remote sources, or those with intermittent or periodic power availability. Their product suite includes light pole power adaptors, and power-over-Ethernet splitters to connect to wireless backhauls and endpoints. These products have been field proven by smart grid names like Tropos Networks and Motorola. Solis was founded in 2005 to meet the high reliability demands and critical infrastructure of the telecom industry.

Roper Industries (Sarasota, FL) is a diversified growth company that provides engineered products and solutions to a wide customer base. The company aligns itself with the Energy Systems & Control industry, helping businesses focus on aftermarket customer needs like productivity in transporting energy and utility and plant safety inspections, along with regulatory testing.

2.5 Smart Grid Security and Interoperability to Advance, but to What Degree?

Security and interoperability are two key areas of the smart grid where there is an ongoing push for technological advancement, but where the ultimate outcome still remains far from clear. With respect to security, the underlying issue is how much utilities will be willing to spend on avoidance, that is, on investments whose benefit may forever remain unknown. Many of the smart meters that have been deployed to date are currently using wireless communications encryption technology that is two to three generations behind the state of the art. Meanwhile, it's unclear if utilities will bear the costs that will be necessary to bring them up to a level that some have termed "FERC compliant."

In terms of interoperability, while NIST (National Institute of Standards and Technology) has moved into the next phase of their efforts, we expect that the standards in this industry, though guided in part by the work at NIST, will largely be determined from the inside out. Company cliques, consortiums and partnerships continue to form, and potentially will lay the groundwork for what emerges as the agreed-upon standards (whether or not those are sanctioned by relevant standards bodies, such as NIST, IEEE, etc.).

Sypris Electronics (Tampa's branch of Sypris Solutions) has been developing assurance, management, and security solutions for the Department of Defense since the 1960s. They are now leveraging their expertise into the smart grid field, with a \$3.1 million

federal grant to develop a centralized cryptographic key management system to protect the national grid from cyber attacks. Sypris was one of eight companies chosen for DOE Security funding. With so much of the infrastructure from public and private sectors tied to the internet, protecting the smart grid is imperative.

Infrax Systems, headquartered in Pinellas Park, FL, focuses on smart grid security. They are a “pure-play” company, with a suite of solutions along the entire path of the smart grid: from AMI, to substation automation, to data management. They’ve dubbed their service the Secure Intelligent Energy Platform (SIEP). Infrax competes against the heaviest of AMI hitters: Silver Spring, Trilliant, and Current Group, among others.

3 CONCLUSION: FLORIDA'S ROLE IN THE FUTURE OF SMART GRID

Florida understands the business growth potential in this market and its established strengths in the energy, telecommunications and information technology sectors can position it for leadership in the emerging smart grid industry. Smart grid innovations at the state's utilities and numerous private companies are likely to result in continued growth for these enterprises, accompanied with the creation of a substantial number of jobs and capital investment. With each major smart grid submarket finding an early foothold here, all necessary solutions that must accompany the merging of energy, telecommunications and information technology have their drivers in place in Florida.

Florida's Cleantech Cluster

Ranked #3 in cleantech businesses, Florida is on the leading edge of cleantech innovation. With abundant natural resources, world-class talent, a favorable business climate and a large market for cleantech products, Florida offers ideal conditions for the industry's development. To learn more about expanding your cleantech business in Florida, contact Enterprise Florida, the state's official economic development organization, at 407.956.5600 or visit www.eflorida.com/cleantech.

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